

EXHIBIT 82

IEC

**Expert Statement:
Rebuttal of Expert
Reports Provided by
Dr. Thomas O. Jackson and
Trevor E. Phillips**

Groundwater Damages in the
Matter of:
*Sullivan et al. v. Saint-Gobain
Performance Plastics
Corporation*
Case No. 5:16-cv-00125-GWC

1 August 2018



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INTRODUCTION

This expert statement is submitted in connection with *Sullivan et al. v. Saint-Gobain Performance Plastics Corporation*, 5:16-cv-00125-GWC. In it I rebut the Expert Reports of Dr. Thomas O. Jackson and Trevor E. Phillips (Jackson, 2018; Phillips, 2018). The opinions contained in this statement are based on my personal and professional knowledge. My conclusions are expressed to a reasonable degree of certainty and are consistent with the standards of the profession of environmental damage assessment. Staff at Industrial Economics, Incorporated (IEc) provided me with technical and administrative support in completion of this work, all under my direction. I continue to gather information, and the situation continues to evolve. As such, I reserve the right to update this opinion as new information becomes available, or should Dr. Jackson or Mr. Phillips express additional or amended opinions.

SUMMARY OF OPINION

I was asked to review and rebut the Expert Reports of Dr. Thomas O. Jackson and Trevor E. Phillips (Jackson, 2018; Phillips, 2018). Both of these reports address the topic of property value diminution in the Town of Bennington and Village of North Bennington resulting from the presence of PFOA contamination in groundwater.¹

Mr. Phillips applies appraisal techniques and concludes that there is no evidence of property value diminution resulting from the presence of PFOA in groundwater underlying the Town of Bennington and Village of North Bennington. Specifically, based on his analysis of 10 sales of residential property, he concludes that owners of property within the Zone of Contamination defined by the State of Vermont² have experienced no loss of use and enjoyment of their properties as a result of groundwater contamination (Phillips Opinion, Page 1). In reviewing Mr. Phillips' report, I consider whether he provides a reliable and appropriate basis for reaching this opinion.

Dr. Jackson expresses opinions “*...regarding the suitability of the proposed class in this matter for purposes of analyzing property value diminution on a common, class-wide basis.*” (Jackson Opinion, Page 1). However, the plaintiffs in this case

¹ A brief review of the situation regarding PFOA contamination of groundwater in Bennington is contained in my Expert Opinions on added cost and replacement cost damages, dated 31 August 2017 and 15 December 2017.

² The “Zone of Contamination” is defined as “those areas of North Bennington and Bennington, Vermont, designated by the State of Vermont as Designated Areas of Concern in North Bennington and Bennington, due to the presence of PFOAs in groundwater, the boundaries of which being most recently delineated on April 17, 2017.” (Plaintiffs’ Third Amended Complaint, filed 10/5/2017, page 18-19)

are not in fact seeking class certification for purposes of establishing monetary damages associated with property value diminution. Thus, I do not focus on Dr. Jackson's opinions regarding the appropriateness of class certification in this matter.

Nevertheless, while the plaintiffs are not seeking class certification for purposes of establishing property diminution damages, it may be efficient and reasonable to consider groups of plaintiffs with common characteristics in the context of litigating or settling individual property value diminution claims. That is, the processes and factors that would lead to diminution of property values would be expected to be common to properties within the Zone of Contamination. As such, I review Dr. Jackson's opinions that may be relevant to individual plaintiff's claims for property value diminution. I also review his opinions to the extent that they are relevant to Mr. Phillips' opinions.

My summary of the opinions of these two expert reports follows:

- Mr. Phillips' assertion that the appraisal technique is the only available and appropriate method to apply in this matter is incorrect and misleading, and is inconsistent with Dr. Jackson's published literature.
- Mr. Phillips' assertion that owners of real property within the Zone of Contamination are unqualified to testify as to the diminution in their homes' values resulting from PFOA contamination of groundwater is unsupportable.
 - Mr. Phillips' opinions regarding the inability of residents to testify reliably as to the magnitude of property value diminution they have suffered is inconsistent with the plain language of Vermont law: *“The owner of real or personal property shall be a competent witness to testify as to the value thereof.”*³
- Mr. Phillips' opinion is also inconsistent with the fact that widely used property value data reported by the U.S. Bureau of the Census are based on owner-reported values. He also ignores the abundance of public information available to these residents in developing their opinions.
- Mr. Phillips' appraisal-based analysis is inconsistent with the opinions expressed by Dr. Jackson. Specifically, in pairing residential properties across neighborhoods for purposes of identifying a property-value effect of groundwater contamination, Mr. Phillips performs the very

³ [12 V.S.A. § 1604](#); see also *Edwards v. Town of Stowe*, No. 2013-439, 2014 WL 3714889, at *3 (Vt. June 12, 2014) (three-judge panel of Vermont Supreme Court affirmed determination that accepted property owners' valuations of their own parcels, over “expert” valuations proffered by Town of Stowe).

comparison Dr. Jackson says is inappropriate given neighborhood differences.

- Mr. Phillips' appraisal-based analysis is overly subjective for the task at hand. There is simply no way to know how any of the factors he cites enter into his analysis, or how changes in those factors would impact his conclusions. There is no means to assign a degree of confidence the jury should have in his conclusions.
- The approach Mr. Phillips uses to detect the potential impact of groundwater contamination on the market value of residential property in Bennington is limited. A simple analysis shows that property owners could have suffered significant losses in property values that his method would fail to detect.
- Mr. Phillips' conclusion that plaintiffs have experienced no loss of use or enjoyment of their properties, based on his subjective appraisal, is unsupportable.
- Despite having published on econometric (i.e., large sample statistical) approaches to determining whether residential properties have experienced diminution in value as a result of environmental contamination, Dr. Jackson does not mention this literature or consider the transfer of values from the published economics literature to inform the Court's understanding of property diminution in this matter.
- Contrary to the opinions of Mr. Phillips and Dr. Jackson, the economics literature supports the named plaintiffs' testimony that their residential property values have been impacted due to the presence of groundwater contamination.
- Factors that Dr. Jackson and Mr. Phillips call out in their opinions – specifically the length of time residents have owned their homes and the presence of other potential sources of environmental contamination – are irrelevant to this matter and overly subjective. Dr. Jackson and Mr. Phillips fail to describe how these factors are taken into account in developing their opinions. As such, it is not possible to determine how their opinions would change if those factors changed or were determined to be irrelevant.
- Dr. Jackson's use of definitions from the appraisal literature to determine when a property is harmed is inappropriate and unsupportable for use in this matter, and is inconsistent with sound environmental science.
- While plaintiffs are not seeking class certification for adjudication of their property-diminution damages, basing such damages on a percentage reduction, or a series of percentage reductions, in property value for all

owners of real property within the defined Zone of Contamination, would be consistent with the economics literature and with well-accepted practice within the field of environmental economics.

QUALIFICATIONS TO OFFER THIS EXPERT OPINION

I am a Principal with Industrial Economics, Incorporated (IEc). IEc is an economics and environmental policy consultancy located in Cambridge, Massachusetts. Founded in 1981, we are the leading environmental and natural resource damage assessment firm in the U.S. I served as a Managing Director and President of IEc from 2000 to 2011, and I have been a Principal with the firm for more than 25 years.

My work at IEc involves the use of economics to assign values to environmental change. This includes methods used to establish economic damages that can result from groundwater contamination. I have worked on dozens of cases involving the assignment of monetary damages to individuals, classes of individuals, firms, and the public as a result of groundwater contamination and conflicts over groundwater use. I have testified in deposition and have been accepted as an expert in court on this topic. My clients include both plaintiffs and defendants in these matters. My work has involved developing expert opinions on the appropriate use of economics to assess the value of groundwater and the economic changes resulting from a change in the services provided by groundwater. These assignments have also involved assessment of added costs to public and private entities, property value diminution, replacement costs, market values, and option values. My expert opinions in this matter are based on this experience and demonstrated expertise.

Of relevance to this opinion, I have assessed the impact of environmental contamination on residential home values at various sites across the U.S. For example, I estimated the reduction in the value of nearby residential properties that resulted from groundwater contamination from refinery operations at a site in Illinois; from contaminant releases to air, soil, and groundwater at a waste processing facility in Indiana; and from contaminant releases from a power plant in Rhode Island. I served as an expert witness in claims brought against a pesticide and fertilizer distribution facility in Westgate, Florida. In that case I both developed a property diminution model and critiqued a “mass appraisal” model developed by the opposing witness. I directed efforts to apply benefits transfer, or the use of existing values from the published literature, to estimate property value losses at a groundwater contamination site outside Chicago (*LeClerq, et al. v. Lockformer, et al.*). In this same matter I led the critique of a hedonic property model developed by the opposing witness. I served on a team of researchers that used hedonic property value techniques to reveal the role that

hazardous contamination of New Bedford Harbor, Massachusetts played in local real estate values. For the Atlanta Regional Commission I assessed the likely impact on regional property values that would occur from a draconian change in water supply in the Atlanta area.

I have written guidelines for Federal agencies on the use of hedonic, or property valuation, techniques to assess damages due to the release of hazardous substances, and was a co-author of one of the first studies that used a repeat-sales approach to assess the impact of environmental contamination on property values (Mendelson, et al. 1992). I have worked on policy-related projects that applied hedonics to understand the role Endangered Species Act regulatory requirements have on land values and regional development, and the role that open space, in particular National Wildlife Refuges, have on property values.

A partial list of the projects in which I have been involved is included in my Curriculum Vitae (Attachment A). This vita also lists peer-reviewed published papers I have authored. Outside of this present matter, I have presented sworn deposition testimony in one case in the past four years. That testimony was for the U.S. Department of Justice and addressed the appropriate measurement of the economic benefits of environmental restoration (in the matter of: U.S. and the State of Wisconsin v. NCR Corporation, et al., Civil Action No. 1-CV-00910).

DISCUSSION OF OPINIONS

In this section I provide discussion of the basis of my opinions.

Mr. Phillips' assertion that the appraisal technique he uses is the only available and appropriate method to assess property value damages is incorrect and misleading.

Mr. Phillips frames his opinions on property value diminution damages on the assertion that his approach – the appraisal technique – is the only appropriate method for use in establishing property value diminution damages in this matter. Mr. Phillips states “*Valid and reliable opinions of property valuation diminution, if any, must be based on appropriate market data and must be developed using generally accepted appraisal methodology*” (Phillips Opinion, Page 3) (emphasis added). He goes onto state that “*Named Plaintiffs' claims of property value diminution are unsupported by the analysis of appropriate market data using generally accepted appraisal methodology. Accordingly, their claims are neither valid nor reliable*” (Phillips Opinion, Page 3).⁴

⁴ Note that Dr. Jackson, unlike Mr. Phillips, limits his opinion to state “[t]here is no appraisal methodology or technique that could reliably estimate diminution on a class-wide basis given the diversity among properties and their locational and environmental condition.” (Jackson, Page 1) (emphasis added).

Mr. Phillips' assertion that the appraisal technique he uses is the only available and appropriate method for assigning property value diminution in this case is incorrect and misleading.

- First, Mr. Phillips' opinion regarding the ability of residents to reliably testify as to the magnitude of losses they have suffered is inconsistent with the plain language of Vermont law: "*The owner of real or personal property shall be a competent witness to testify as to the value thereof.*"⁵"
- Second, his opinion is inconsistent with Dr. Jackson's published work. Dr. Jackson has published on a commonly applied and widely accepted econometric technique, the hedonic property valuation method (Jackson, 2001). This method has been widely applied for determining the impact of contamination on residential values. Despite knowledge of this method, neither he nor Dr. Jackson considers the use of market-wide data in establishing their opinions, or states why such a method could not be applied in this matter.

An additional basis for rejecting Mr. Phillips' assertion regarding the unique ability of appraisal techniques to assess property value damages is found in the U.S. Environmental Protection Agency's guidance for the conduct of economic analysis.⁶ This guidance was developed to establish best practices for understanding the economic implications of environmental change, and notes the availability of hedonic techniques and other methods (e.g., stated preference) for monetizing environmental factors. It is notable that that guidance does not reference the appraisal method used by Mr. Phillips.

Finally, in addition to Vermont Statute, the U.S. Census Bureau relies on owner-reported values for residential property in its published and widely used statistics (U.S. Census Bureau, American Community Survey (ACS)). These values represent respondents' estimates of how much their property (house and lot) would sell for if they were for sale.

Given the existence of other widely accepted methods – including use of self-reported home values – I believe that Mr. Phillips misleads the Court in stating that the appraisal approach is the only approach available to value residential property.

⁵ [12 V.S.A. § 1604.](#)

⁶ U.S. EPA, *Guidelines for Preparing Economic Analyses*, 2010.

Mr. Phillips' assertion that residents in the Zone of Contamination are unqualified to testify as to the diminution in their homes' values is unsupportable.

Mr. Phillips' assertion that residents in the Zone of Contamination are unqualified to testify as to the diminution in their homes' values is unsupportable and inconsistent with Vermont law, the practices of the U.S. Census Bureau, and the simple fact that there is an abundance of information available to property owners to develop their opinions.

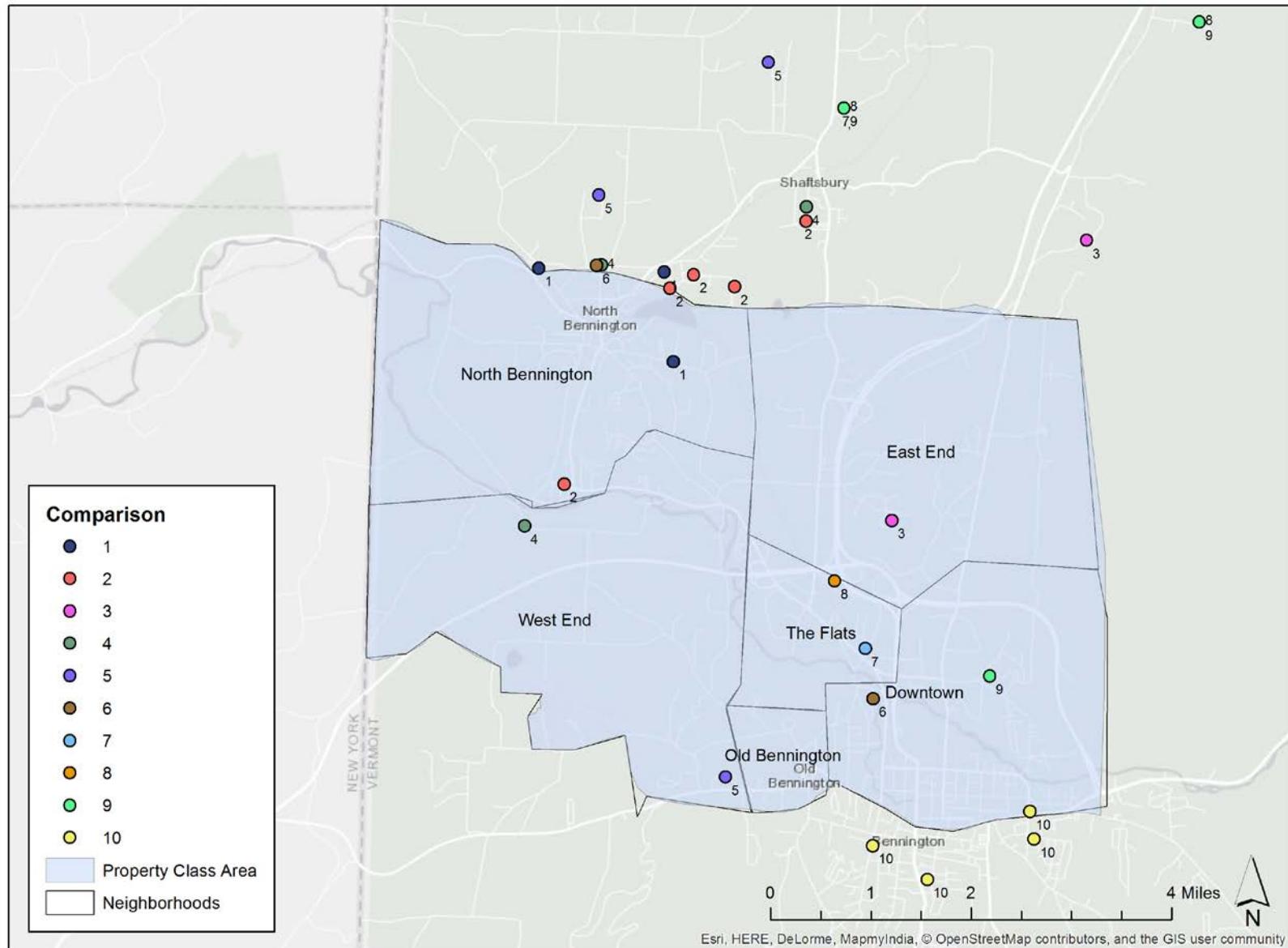
As noted above, Vermont law clearly recognizes property owners as competent to testify as to the value of their property (12 V.S.A. § 1604). In addition, owner-reported home values are collected and considered reliable by the U.S. Census Bureau, and widely used by economics researchers. Further, members of the public who are not appraisers commonly – and almost exclusively – rely on their knowledge of markets and the substantial volume of publicly available information to determine what they believe their own and others properties are worth. For many, their home is their most valuable asset, and many homeowners pay close attention to local property markets. With the abundance of on-line home valuation information and valuation tools (e.g., Zillow, Redfin), there is no reason to believe that a homeowner is incapable of expressing an informed opinion on the change in home value that would result from the presence of a new environmental disamenity, such as groundwater contamination, or that residents are unqualified to testify as to the diminution in their homes' values.

Mr. Phillips' analysis is inconsistent with the opinions expressed by Dr. Jackson. Dr. Jackson's opinions undermine Mr. Phillips' analysis.

Mr. Phillips' analysis is inconsistent with and contrary to the opinions expressed by Dr. Jackson. Dr. Jackson states that neighborhoods within Bennington are too dissimilar to be considered as a class (Jackson Opinion, Page 15), while Mr. Phillips compares properties across neighborhoods in his analysis (Phillips Opinion, Page 6). Specifically, in pairing subject and comparison residential properties across neighborhoods for purposes of attempting to identify a property value effect of groundwater contamination, Mr. Phillips performs the very comparison Dr. Jackson says is inappropriate given neighborhood differences.

The data and assumptions underlying Mr. Phillips' analysis are made clear in Exhibit 1. This exhibit shows the locations of the 10 "subject" sales (numbered 1 through 10) in the Zone of Contamination, and the 17 "comparison" or control properties. For the control properties I note which subject sale they are intended to be similar to. In some cases, sales are used as controls for more than one control property.

Exhibit 1. Map of Neighborhoods as Identified by Jackson, with Phillips' Property Comparisons



As shown in Exhibit 1, despite Dr. Jackson's express concern regarding cross-neighborhood comparisons, Mr. Phillips proceeds to conduct an appraisal that compares the price of homes presumably affected by the contamination event with homes presumed to be unaffected, not only across neighborhoods but across towns, in one case, six to seven miles away.⁷ In the case of 99 Airport Road, he appears to consider that property's neighborhood to be fairly compared to two or three separate neighborhoods in Bennington,⁸ all of which Dr. Jackson finds too different to incorporate into a single class. While Mr. Phillips may argue that, given extensive groundwater contamination, he had to go outside these neighborhoods for his controls, he fails to replicate the lot and price analysis presented by Dr. Jackson to determine if the neighborhoods are indeed "similar enough" for comparison purposes, or to conduct any quantitative analysis to attempt to control for this factor.⁹ As such, Mr. Phillips' analysis cannot be seen as reliable, and the opinions of these two experts are irreconcilable with one another.

In addition to conducting an analysis that is inconsistent with Dr. Jackson's opinion, another underlying flaw of this cross-community appraisal is that the disamenity of having contaminated groundwater could simply be offset by another amenity (e.g., distance to commercial centers). By failing to control for those factors, Mr. Phillips' analysis is not capable of supporting his conclusion.

In addition, as shown in Exhibit 1, several of the control properties are very close to the Zone of Contamination (e.g., eight of the 17 controls fall less than one-quarter mile from the Zone). It is reasonable to ask whether buyers in the market for a home in the area would make such fine distinctions in considering a purchase, and thus whether the analysis conducted by Mr. Phillips is biased by this factor.

Dr. Jackson presents the opinion that the "...properties within the proposed class are too diverse in location, ownership, property type and characteristics, and the environmental issues in the area are too variable for class-wide aggregation of properties for the purpose of uniformly estimating diminution in value." (Jackson Opinion, Page 1). In support of his opinion, Dr. Jackson presents a series of factors and characteristics that he believes differ across properties in the proposed

⁷ Mr. Phillips considers ten subject properties, and for each identifies three to five control properties. However, he uses the same controls in many cases. As a result, he actually only considers 17 controls in his analysis.

⁸ One of the subject properties is on the dividing line between two neighborhoods.

⁹ Similarly, he may argue that he would not make that comparison, since differences in prices are precisely the factor he is trying to measure, but he could simply have looked at prices pre-event to determine similarity based on Dr. Jackson's expressed rule.

class. These factors and characteristics include whether or not the property was on municipal water prior to discovery of PFOA in Bennington's groundwater; which neighborhood the property is located in; what the observed concentration of PFOA in groundwater was for each property; whether the property required and received a point-of-entry treatment system for its well water; the "condition" of the property; proximity to "open wilderness," highways, and the former Chemfab facilities; "creek frontage"; and a host of other factors. Further, in determining that the "*named plaintiffs in this matter are not typical or representative of most of the properties in the proposed class area*" (Jackson Opinion, Page 16, emphasis added),¹⁰ he lists attributes that include the square footage of the home and lot, the age of the home, the number of bedrooms and bathrooms, the type of siding, a qualitative description of condition, and the year in which the owner purchased the property, among other factors.

Unfortunately, Mr. Phillips does not explain how these factors, considered to be key to sound analysis by Dr. Jackson, are considered in his appraisal analysis. While he qualitatively describes some of these factors for his subject and comparison properties (e.g., number of bedrooms), there is no means to determine how each entered into his analysis, or how any changes in these factors would affect a property's sale price or his conclusions.

In addition, in a 2010 paper Dr. Jackson published on property valuation in the context of environmental class actions, he states:

"One technique that has been increasingly employed to estimate [environmental] risk effects is multiple regression analysis. This technique can be properly employed to estimate average impacts to groups of properties that share similar characteristics and are similarly situated."

(Jackson 2010).

Recognizing that this commonly applied approach produces a measure of average impacts, Dr. Jackson goes on to discuss the consideration of property characteristics in allocating damages to produce an equitable and reliable allocation of damages across a class. Dr. Charles Mullin, another of the defense expert witnesses, also cites this literature in his opinion, stating:

"An EPA study combining data across multiple contamination sites found that home values may initially decline 3%–6%, but, after remediation, return to their pre-event levels or higher (4% to 9% appreciation)."

(Mullin Opinion, Page 5).

¹⁰ Dr. Jackson uses the term "most" in this opinion, leaving open the question as to whether a subclass could be reasonably defined for some of the residential properties in the proposed Class area.

Given Dr. Jackson's publication, and Dr. Mullin's reference to this literature in his opinion, it is not clear why Mr. Phillips did not also consider this literature. While the property diminution values presented by Dr. Mullin are relatively modest, some of the sites included in the EPA study did not have residences with closed private wells (see Kopp, Appendix F). In addition, for some of these sites, the contamination in question is far from the subject properties, as opposed to being imposed directly on property owners within a defined Zone of Contamination (Kopp, Appendix F).¹¹ Finally, there is no planned active remedy for the Bennington PFOA site; PFOA will remain in groundwater above levels of concern for many years to come. Thus, the natural conclusion to draw, if any, from this report is that home values will in fact be permanently depressed.^{12, 13}

In any case, Mr. Phillips ignores this well-accepted literature, which contradicts his conclusion that no other viable methods of assessing property value diminution exist. He could have also have relied on this literature - but did not - to inform his opinion as to the possible reduction in property values from PFOA contamination of groundwater in Bennington.

Mr. Phillips' appraisal-based analysis is not up to the task at hand.

Mr. Phillips' appraisal-based analysis is overly subjective for the task at hand. There is simply no way to know how any of the factors he says he considered enter into his analysis, or how changes in those factors would impact his conclusions. For example, in describing one of his comparisons, he states:

"The subject of this analysis (PCA Sale-R1) is a detached single-family residence located within the PCA at 88 Mechanic Street, North Bennington, VT. The property consists of a 2,571 square foot home with three bedrooms and three bathrooms on a 0.73 acre lot. Sale R1-1 at 315 Bank Street, Shaftsbury, VT, is similar to the subject because its smaller living area, fewer bathrooms, and location on a busy street is balanced out by its superior lot features and site improvements and its finished basement." (Phillips Opinion, Paragraph 56, Page 36).

¹¹ The impact of a disamenity, such as the presence of a hazardous waste site, would be expected to be a negative function of the distance to the site.

¹² While the EPA study found that home prices might rebound once a remedy is put in place, there is no economic theory that would support prices rising as a result of proximity to a disamenity such as contaminated groundwater.

¹³ Note that the timing of when losses are calculated may matter. For example, if damages are properly expressed at the time of an adverse harm, the fact that the prices may recover some day would be irrelevant to the damage claim.

It is simply impossible to determine how these various “balancing” factors offset against one another, how the results might change if a different set of subject properties were selected, or how the results might change if another assessor conducted the comparison. As such, the appraisal analysis conducted by Mr. Phillips is *ad hoc* and likely incapable of detecting an effect of contamination on the value of the 10 homes he considered.

Fatally, the “bracket” analysis Mr. Phillips’ performs does not support the conclusion he reaches. Mr. Phillips states:

After comparing, analyzing and making adjustments for sale and property differences, the comparable properties can be used to form a reasonable market range for the subject property. (Phillips Opinion, Page 18).

He goes on to quote the Appraisal Institute’s *Seminar Handbook, Analyzing the Effects of Environmental Contamination on Real Property*, which forms the standard for the analysis he performs:

If the prices of the unimpaired comparable sales are consistent with or “bracket” the price of the subject property, then there would be no indicated property value diminution due to the environmental condition of the subject property.¹⁴

That is, following this approach the appraiser considers whether a subject property’s price falls in the “bracket” of prices for comparable properties. As such, the appraiser can only draw a conclusion as to whether the observed price of the subject property is outside or inside the “bracket” of sales he has qualitatively determined to be comparable.

To show the limitations of this method, in Exhibits 2 and 3, we consider the extent to which the subject properties could have been depressed in value due to contamination without falling outside the comparison bracket. Exhibit 2 shows the observed sale price for subject property number 9 (4 Carpenter Lane), which was \$116,000. For this property Mr. Phillips identified four comparison sales, which had sale prices ranging from \$90,000 to \$160,000. Following the Appraisal Institute’s *Handbook* (2010), Mr. Phillips concludes that the subject property’s sale price falls in the “bracket” of the four observed control properties. As a result, he concludes that there is no observable effect of groundwater contamination on the subject property’s home value.

However, as is shown in Exhibit 2, the subject property’s value could have been depressed by as much as 27.5 percent and it still would have fallen in the observed

¹⁴ Appraisal Institute, *Seminar Handbook, Analyzing the Effects of Environmental Contamination on Real Property*, (Chicago: Appraisal Institute, 2010), part 4 – 46.

bracket. For example, if this property would have sold for \$159,000 absent contamination, its market value would still be in the bracket, and thus Mr. Phillips would have come to the same conclusion: no effect of contamination on property value.

As shown in Exhibit 3, the impact of the presence of PFOAs in the sales Mr. Phillips considers could be at least four percent higher, and as much as 27.5 percent higher, absent contamination and still fall in the bracket of comparable sales. As a result, even if these properties had values depressed by four to 27.5 percent, Mr. Phillips would still conclude that there is no measurable effect on property prices given the presence of groundwater contamination. Since the selection of properties for inclusion as comparison sales is subjective and limited to just a few properties for each subject, the actual percentage is likely even greater. Note that for several of these properties the potential diminution is on the order of diminution percentages to which the plaintiffs' have testified (20 percent to 34 percent). This analysis also highlights a fatal flaw in Mr. Phillips' analysis: he cannot provide a measure of the statistical confidence he has in the results of his appraisal analysis, but can only express a qualitative conclusion with a broad range of uncertainty.¹⁵

Phillips' conclusion that plaintiffs have experienced no loss of use or enjoyment of their properties is unsupportable.

Mr. Phillips states that:

“Among the sales I have analyzed within the Proposed Class Area, there is no market evidence of property value diminution.” (Phillips Opinion, Page 31).

He further states,

“Among the sales I have analyzed within the Proposed Class Area, to the extent that the market recognizes any contributory value for use and enjoyment, the lack of market evidence of property value diminution undermines Plaintiff’s claims for loss of use and enjoyment.” (Phillips Opinion, Page 3).

In effect, Phillips concludes that the wide-scale presence of contamination in this community went unnoticed in the real estate market.

¹⁵ This limitation of the appraisal approach to analysis of property diminution resulting from environmental contamination was raised over a decade ago by Dr. William Kinnard (1992).

EXHIBIT 2 ANALYSIS OF SUBJECT PROPERTY NUMBER NINE

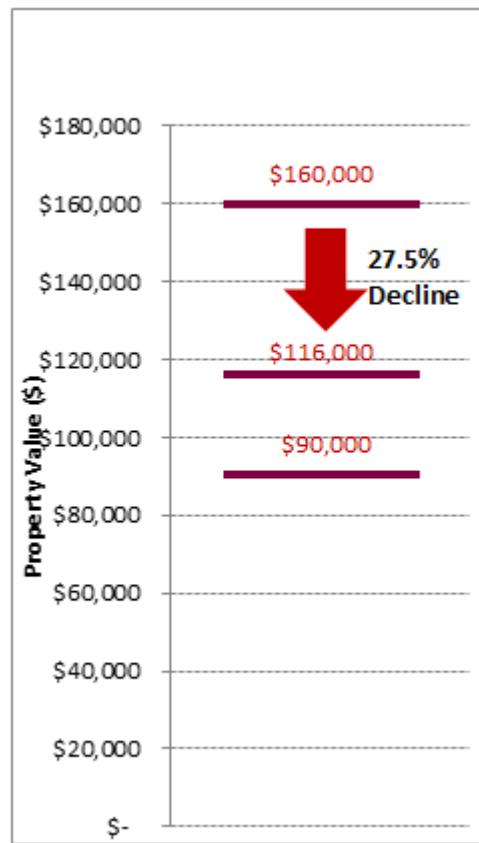


EXHIBIT 3 SENSITIVITY TEST ON PHILLIPS' APPRAISAL ANALYSIS

GROUP	SUBJECT PROPERTY SALE VALUE	COMPARISON SALE VALUE (LOW)	COMPARISON SALE VALUE (HIGH)	POTENTIAL PERCENT DECREASE IN SUBJECT PROPERTY VALUE FROM HIGH COMPARISON VALUE WHILE STILL REMAINING IN "BRACKET"
1	\$ 244,500	\$ 240,000	\$ 255,000	4.1%
2	\$ 158,750	\$ 150,000	\$ 182,500	13.0%
3	\$ 305,000	\$ 275,000	\$ 320,000	4.7%
4	\$ 145,000	\$ 125,000	\$ 162,400	10.7%
5	\$ 201,000	\$ 185,000	\$ 225,000	10.7%
6	\$ 172,313	\$ 162,400	\$ 185,000	6.9%
7	\$ 90,000	\$ 90,000	\$ 122,500	26.5%
8	\$ 122,000	\$ 90,000	\$ 160,000	23.8%
9	\$ 116,000	\$ 90,000	\$ 160,000	27.5%
10	\$ 147,000	\$ 132,400	\$ 153,000	3.9%

As noted above, Mr. Phillips' subjective appraisal analysis does not support his conclusion that plaintiffs suffered no loss of use or enjoyment of their properties. In addition, as discussed below, the published economics literature cited by Dr. Mullin -- and to which Dr. Jackson has contributed -- shows that home values are generally impacted at contaminated sites such as this. Despite this widely accepted literature, Mr. Phillips concludes that the presence of contamination in Bennington has resulted in no change in home values based on a subjective analysis of only 10 selected sales.

Dr. Jackson and Mr. Phillips ignore relevant hedonic valuation techniques and literature.

As noted above, there is a rich literature of published economic studies that address the role of environmental disamenities, particularly stigma, in determining real property values (Hite et al., 2001). Stigma in this context refers to an adverse public perception of a property or neighborhood due to some negative factor – in this case groundwater contamination. Such stigma can persist even after health risks are addressed. The most commonly applied method in this literature to reveal the effect of a disamenity on property value is referred to as “hedonic analysis.” Hedonic analysis uses well-established econometric techniques, based on large sample statistics, to determine the contributing factors to real property values. This literature provides support for the plaintiffs’ opinions in this matter that their property values have diminished due to PFOA contamination, and provides evidence for a persistent impact on property values given the lack of an active remedy to resolve groundwater contamination at this site (State of Vermont, 2018).

While Dr. Jackson has published in this literature (Jackson 2001), he does not reference the literature or consider the transfer of values from the published economics literature for use in determining property diminution at this site. However, such methods have been applied successfully in similar matters. For example:

- Dr. Raymond Kopp testified as to property value diminution in a case involving groundwater contamination in a residential neighborhood outside of Chicago. In that community, like Bennington, residential property owners were forced to hook-up to municipal water to avoid the risks associated with exposure to contaminated groundwater. Dr. Kopp used “benefits transfer”, or information from existing studies in the literature, to assign a percent diminution in value of five percent from fair market value. He also testified that this property value effect would continue even after homes in the affected neighborhood were connected to municipal water and full knowledge of the situation existed in the market

(Kopp 2001). In that case, recovered damages (as the result of a settlement) were distributed based on home value and some other class-member characteristics.

- Dr. David Sunding recently testified in a case involving PFC contamination of groundwater in Washington County, Minnesota (outside of St. Paul). Similar to the Bennington situation, groundwater contamination in that area is extensive. Dr. Sunding studied residential property price patterns and used hedonic techniques to assess the impact of awareness of contamination on home values. In that case households were already connected to municipal water; hence the diminution value found by Dr. Sunding represented the permanent impact to property values associated with the stigma of proximity to contaminated groundwater. Dr. Sunding found the houses in the primarily affected communities fell in value by approximately four to seven percent.

The hedonics literature provides measures of the percentage diminution in property value expected to result from the presence of significant environmental disamenities. Dr. Jackson published a paper that describes this literature, and found that of the 19 studies he considered, 15 found an adverse price impact associated with the presence of a hazardous waste site (Jackson 2001). As discussed above, Dr. Kopp considered this same literature and concluded that he would expect a permanent property value impact given ongoing groundwater contamination (Kopp 2001). While this literature also indicates that any impact on real estate values may disappear after remediation occurs, in this case, no primary remediation is envisioned – that is, while properties will be connected to clean water sources, contamination will exist in groundwater for the foreseeable future. Given the use of large sample statistics, hedonic analyses also provide measures of the statistical confidence we can have in the results of such analyses. This contrasts with the appraisal approach used by Mr. Phillips, for which he is unable to define the degree of confidence we should have in his appraisal results.

Factors Dr. Jackson and Mr. Phillips claim support their opinions are irrelevant to the matter at hand and overly subjective.

Dr. Jackson and Mr. Phillips both highlight “*Environmental disamenities within and surrounding the proposed class area.*” (Jackson Opinion, Page 14, Table 3). These purported disamenities include the presence of other hazardous waste sites in the area, “*pesticide enforcement actions*”, and “*spills reported to the state*,” among others. While they spend a considerable portion of their reports describing these factors, they fail to describe how these factors should be taken into account in determining the magnitude of property value diminution. As a result, while they subjectively believe these disamenities to be important, it is not possible to

determine objectively how their opinion would change if those factors changed, were determined to be irrelevant, were found to be in error, or were properly controlled for in a regression analysis. For example, if one or more of the “spills reported to the state” were fully remediated with no ongoing environmental harm, why would their historical occurrence matter to damages in this case?

Since these factors and events existed prior to the discovery of PFOA, their impact, if any, on property values would be incorporated into the pre-event market value of these residential properties. In that case, the impact of the discovery of PFOA on property values would be in addition to those existing values. As such, these disamenities are irrelevant to the determination of damages in this matter. In short, the presentation of this list of environmental issues within the “environmental history” report presented by Dr. Jackson and Mr. Phillips is nothing more than a poorly veiled attempt to make it appear that the plaintiffs’ properties were already suffering from a range of environmental woes, such that this major PFOA contamination event is rendered wholly irrelevant. Dr. Jackson and Mr. Phillips provide no evidence that these prior environmental woes reduced the harm resulting from the PFOA contamination event.

Importantly, as noted above, Mr. Phillips’ appraisals do not specifically consider any of these purported environmental events or sites, and he provides no description of how proximity to these environmental disamenities (or not) affected his subject properties or the comparison sales. In fact, Mr. Phillips provides no similar list of environmental disamenities for his comparable sales, making it impossible for him to have considered similar environmental factors. Thus, while Dr. Jackson provides the opinion that “[i]t would be difficult to isolate and analyze the source of any particular environmental contamination event or disamenity, let alone to segregate and quantify the property values impacts, if any, from a single source or contamination event” (Jackson Opinion, Page 14), this is exactly what Mr. Phillips claims to do in developing his opinion.

There are other examples of irrelevant factors raised by Dr. Jackson and Mr. Phillips. For example, in Figure 1, Dr. Jackson presents a summary of “Year of property acquisition.” He states, “*Potential class members who acquired their real property interests in the distant past could have a different set of impacts to those owners who acquired their interests more recently.*” (Jackson Opinion, Page 16). However, nearly all residential property owners purchased their properties prior to widespread public knowledge of contamination (Jackson Opinion, Page 15). As such, with the exception of the few properties purchased after full knowledge of the impact of PFOA contamination, there is no reason to believe that longer tenure in a property would be a determining factor in the damages suffered by all owners of property within the Zone of Contamination.

Similarly, there is no support given by Dr. Jackson for the implied assertion that more or less expensive properties would be affected differently by the presence of PFOA in the groundwater underlying Bennington. As discussed, it is conventional within the economics literature to consider the impact of the presence of environmental contamination, such as groundwater contamination, as a percentage of market value (EPA 2015). As such, the differences claimed by Dr. Jackson in residential property values could be addressed by simply applying an average percent decrement, such as that provided by the named plaintiffs (Kopp 2001). If there are real differences in the degree of harm which need to be addressed for fairness purposes, these differences could be addressed at the stage that property diminution is litigated. This is exactly what Dr. Jackson describes in his 2010 paper on environmental class actions (Jackson 2010).

Dr. Jackson's use of the appraisal literature to define when a property is harmed is inappropriate

Dr. Jackson's reference to the appraisal literature to define what analysis is required and when a property is harmed is inappropriate and unsupportable for use in this matter, and is inconsistent with sound environmental science. Specifically, Dr. Jackson states:

“The individual environmental characteristics of each property within the proposed class area would need to be considered in a reliable analysis of potential property value diminution.” (Jackson Opinion, Page 10).

However, he presents no evidence from past studies or the economics literature to support this contention. For example, would he expect a home buyer considering two different properties, one exhibiting well contamination at twice the Vermont safe standard and one with well contamination at half the standard, to truly draw a distinction, or would the buyer simply consider both properties contaminated? Similarly, would a buyer also consider the fact that contaminant concentrations have, in some cases, varied over time, in making a decision on whether to purchase a home?

Dr. Jackson goes on to quote *Advisory Opinion 9: The Appraisal of Real Property That May Be Impacted by Environmental Contamination* published with USPAP and promulgated by the Appraisal Standards Board (ASB), which defines environmental contamination as follows:

“Adverse environmental conditions resulting from the release of hazardous substances into the air, surface water, groundwater or soil. Generally, the concentrations of these substances would exceed regulatory limits established by the appropriate federal, state and/or local agencies.” [emphasis added] (Real Analytics, 2013).

Dr. Jackson states: “*Using this definition, of the properties that have been tested, some were found to be ‘uncontaminated,’ while others contained PFOA in the groundwater above the applicable Vermont regulatory standard of 20 ppt.*” (Jackson Opinion, Page 11).

While the ASB provides guidance to appraisers that generally limits consideration of “contamination” to those properties exhibiting exceedances of regulatory limits, there is no scientific basis to assert that wells with measurable contamination of PFOAs at levels below the Vermont regulatory standard of 20 ppt, but greater than background, are “uncontaminated.” As stated in recently issued guidance from the Center for Disease Control’s (CDC) Agency for Toxic Substance Disease Registry (ATSDR):

“The Environmental Protection Agency (EPA) has published a Lifetime Health Advisory (LTHA) recommending that the concentration of PFOA and PFOS in drinking water, either individually or combined, should not be greater than 70 parts per trillion (0.07 parts per billion). The LTHA concentrations do not represent definitive cut-offs between safe or unsafe conditions, but rather provide a margin of protection for individuals throughout their life from possible adverse health effects.” [emphasis added] (ATSDR 2017).

In addition, regulatory levels can vary with time, reflecting new information and/or policies. In fact, ATSDR recently set a Minimum Risk Level (MRL) for PFOAs that translates to an 11 ppt threshold in groundwater – below the State of Vermont’s current 20 ppt standard, and thus below the 20 ppt level referenced by Dr. Jackson.

Leaving aside the fact that wells exhibiting measurable levels of PFOAs can be defined as “contaminated,” it is hard to imagine prospective home buyers in Bennington relying on guidance issued to professional appraisers in determining whether a property is contaminated.

Treatment of residential properties in this case as a group would be consistent with sound practice in environmental economics.

Contrary to Dr. Jackson’s opinion, consideration of property diminution damages for all harmed parties, as a group, would be eminently reasonable. The presence of PFOA in groundwater throughout the Bennington community is having a similar impact on all residential properties in the action area. To the extent that there are real, quantifiable differences between harmed parties, those differences could be identified and considered in allocating damages (e.g., residential property owners versus commercial property owners). Assignment of percentage impacts on the value of residential property would work well in a setting such as

this. This approach is exactly what has been used in other cases, including the Lockformer case cited above (Kopp 2001), and is consistent with commonly applied methods from the environmental economics literature.

COMPENSATION

My 2018 rate for expert services in this case is \$375/hour. My rate for testimony in this matter is the same.

INFORMATION RELIED UPON

In addition to the documents and information sources listed in my 15 December 2017 Expert Report, I considered and relied on the following documents in developing this opinion.

Agency for Toxic Substances and Disease Registry (ATSDR). 2018.

Toxicological profile for Perfluoroalkyls. (Draft for Public Comment).

Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Edwards v. Town of Stowe, No. 2013-439, 2014 WL 3714889, at *3 (Vt. June 12, 2014)

Guignet, D., Northcutt, R., & Walsh, P. (2015). *The Property Value Impacts of Groundwater Contamination: Agricultural Runoff and Private Wells* (No. 201505). National Center for Environmental Economics, US Environmental Protection Agency.

Hite, D., Chern, W., Hitzhusen, F., & Randall, A. (2001). Property-value impacts of an environmental disamenity: the case of landfills. *The Journal of Real Estate Finance and Economics*, 22(2-3), 185-202.

Jackson, Thomas (2010). Real Property Valuation Issues in Environmental Class Actions. *The Appraisal Journal*.

Jackson, Thomas (May 9, 2018). Expert Report of Thomas O. Jackson, Ph.D., MAI, CRE.

Kinnard, W. "Measuring the Effects of Contamination on Property Values," *Environmental Watch*, Winter, 1992, 1-4.

Kopp, Raymond J (2001). Expert Report. *LeClerq, et al. v. Lockformer, et al.*, No. 00 C 7164 in the United States District Court for the Northern District of Illinois, Eastern Division. December 3.

Phillips, Trevor (May 9, 2018). Export Report of Trevor E. Phillips. James D. Sullivan, et al. v. Saint-Gobain Performance Plastics Corporation. United States District Court, District of Vermont.

Plaintiffs' Third Amended Complaint, filed 10/5/2017 (Doc. 113)

Real Analytics (2013). *Advisory Opinion 9.*

State of Vermont, Agency of Natural Resources (June 25, 2018). Approval of Corrective Plan-Corrective Action Area 1 – Operable Unit B – May 2018, North Bennington and Bennington, Vermont.

Available: <https://anrweb.vt.gov/PubDocs/DEC/PFOA/Corrective%20Action%20Plan%20OUB/2018-0625-Schmeltzer-Canning-approval-corrective-action-CAA1-OUB.pdf>

State of Vermont (2017). Summary of Bennington and North Bennington PFOA Community Meeting on April 27, 2017. May. Available at: http://dec.vermont.gov/sites/dec/files/co/pfoa/documents/2017_05_04_FINAL_MEMO-Summary-Community-Meeting.pdf

U.S. EPA. 2016. Fact Sheet: PFOA & PFOS Drinking Water Health Advisories. https://www.epa.gov/sites/production/files/2016-06/documents/drinkingwaterhealthadvisories_pfoa_pfos_updated_5.31.16.pdf

Unsworth, Robert (December 15, 2017). Expert Statement: Monetary Damages. Groundwater Damages in the Matter of: Sullivan et al. v. Saint-Gobain Performance Plastics Corporation.

ATTACHMENT A: CURRICULUM VITAE OF ROBERT E. UNSWORTH

ROBERT E. UNSWORTH

PRINCIPAL AND DIRECTOR

Overview

Mr. Unsworth, Principal and Director of Industrial Economics, Incorporated (IEc), is a recognized expert in the field of natural resource economics and environmental damage assessment. In his 32 years of experience he has addressed the full range of issues encountered in environmental damage valuation. From 2005 to 2011 he served as IEc's President, responsible for strategic planning as well as day-to-day operations. In addition to his consulting practice, he currently serves on the Board of the Student Conservation Association, an organization dedicated to the development of environmental conservation skills and work experience in young people of all backgrounds.

Of particular relevance to this matter, his work has addressed private claims for property value diminution due to groundwater contamination, private claims for added costs associated with groundwater contamination, public claims for replacement costs of groundwater resources, valuation of groundwater resources in the context of cost-benefit analyses of regulatory actions undertaken by the U.S. Department of the Interior under the Endangered Species Act, and addressed economic issues in the context of an interstate dispute involving groundwater resources. Specific examples of Mr. Unsworth's qualifications of relevance to this case include:

- Serving as an expert witness and consultant to a range of water economics matters, including:
 - Providing an expert opinion on the conceptually sound approach to groundwater valuation for the City of Memphis, in the context of an intestate water dispute between Memphis and the State of Mississippi.
 - Providing expert opinions in a wide-range of groundwater contamination cases brought by public trustees for groundwater resources. For example, Mr. Unsworth served as an expert witness in a damage claim brought by the State of Ohio against the U.S. Department of Energy (DOE) for damages associated with radionuclide contamination of groundwater at DOE's former Fernald, Ohio facility, and is currently an expert witness in a series of claims for damages due to MTBE contamination of groundwater in New Jersey.
 - Providing technical support to a claim for damages brought by a community of well owners impacted by hazardous contamination, including the added costs of providing municipal water and the use of POETs.

Mr. Unsworth has testified in the context of environmental litigation and before state commissions, including Vermont's Public Service Board.

Education and Professional Experience

Master of Forest Science, Yale University.

Bachelor of Science *magna cum laude* in Forestry, State University of New York.

Mr. Unsworth has served as a member of several expert panels, including the National Research Council, Transportation Safety Board, Committee to Evaluate Alternative Tanker Designs; the Atlantic States Marine Fisheries Commission, Horseshoe Crab and Tautog Management Committees; European panels on environmental liability assessment; and U.S. Environmental Protection Agency panels on approaches to estimate the economic benefits of the Clean Water Act and changes in atmospheric visibility. He is frequently called upon to present on the topic of environmental damage assessment, including groundwater damage assessment.

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Project Experience

Natural Resource Damage Assessment

Examples of Mr. Unsworth's experience in natural resource damage assessment are summarized below.

- For the Hanford Natural Resource Trustee Council, directing the development of an Injury Assessment Plan, a Preliminary Estimate of Damages, and other documents to support planning for one of the most extensive and complex natural resource damage assessments conducted to-date. Injuries considered include terrestrial and aquatic biota, surface water, groundwater, and Tribal lost use services. Trustees include two states, three Tribal governments, and three Federal agencies.
- For the Los Alamos Natural Resource Trustee Council, directing the development of a Damage Assessment Plan, a preliminary injury evaluation, and other documents required to support restoration planning at this site. Resources of concern include groundwater, surface water, terrestrial and aquatic biota, and Tribal lost use services. Trustees include the State of New Mexico, five Federal agencies, and four Pueblo governments. Mr. Unsworth is currently serving as Program Manager for this multi-year, multi-million dollar assessment.
- For State and Federal Trustees, provided technical support in assessing the likely benefits of early restoration projects following the BP Deepwater. Made technical presentations in the context of early restoration settlement negotiations with BP on behalf of the Trustees.
- For the Department of the Interior, assisting in the development of a white paper on issues in assessing cultural lost services in the context of natural resource damage assessment.
- Providing support to the Navajo Nation in assessing impacts due to the Gold King Mine spill.
- Assisting the trustees for Leech Lake, Minnesota in assessing the damages associated with hazardous contamination at that site.
- For the Commonwealth of Massachusetts, developing a general oil spill damage assessment model to be applied to assign damages from small and moderate scale oil spills in terrestrial, aquatic and marine environments.
- For the State of New York, estimated damages resulting from groundwater injuries associated with a catastrophic salt mine collapse. Participated in settlement negotiations with the responsible party.
- For various trustees, providing support in assessing the natural resource damage assessment credits to be assigned to early restoration actions taken in several large scale damage assessments.
- For the U.S. Department of Energy and the U.S. Department of Justice, provided expert testimony and technical support in settlement negotiations in a claim brought by the State of Ohio against the U.S. for groundwater damages resulting from radionuclide releases from the Fernald Ohio site.
- For the U.S. Department of Justice, U.S. Attorney's Office, and the U.S. Forest Service, assessed natural resource damages associated with several large-scale wildland fires, including the Moonlight, Storrie, Big Creek, Freds, Sims and Witch fires. Provided expert deposition testimony in several of these cases.
- For the City of San Diego, assessed natural resource and other economic damages associated with the Witch and Guejito fires. Developed expert opinion on damages and assisted in settlement negotiations.
- For Sonoma County, California, assessed natural resource damages associated with the Geyser's fire. Assisted in settlement negotiations.

- For the Territorial Government of the U.S. Virgin Islands, provided an expert opinion and expert testimony regarding natural resource damages resulting from groundwater contamination at the Tutu well fields site on St. Thomas. Research considered added costs, the public's willingness to pay for a replacement water supply, and the non-use values associated with the contaminated aquifer.
- For the U.S. Department of Justice and the U.S. Army, assessed damages associated with groundwater contamination at the Twin Cities Army Ammunitions Plant in Minnesota. Assisted in settlement negotiations between the Federal government and the state.
- For the State of New York, assessed groundwater damages associated with a large-scale salt mine collapse.
- For the States of Kansas, Oklahoma, and Missouri, provided an expert opinion in the context of a bankruptcy proceeding as to groundwater damages due to mining activity in the Tristate Mining district.
- For the State of New Jersey, provided expert opinions of groundwater damages at over a dozen sites in the State.
- Assisting in the resolution of a claim for ecological injury and recreational fishing losses resulting from the release of PCBs to Lake Hartwell, South Carolina/Georgia, and an associated tributary. Provided technical support to a cooperative assessment of damages and in the development of a formal Restoration and Compensation Determination Plan.
- Assisting in the development of a preliminary damage estimate and providing technical support to negotiations between Trustees and the responsible party at the Palmerton Zinc Superfund site in Pennsylvania. Categories of loss considered include ecological services associated with injured forested and aquatic ecosystems, as well as recreational fishing, hunting and timber harvest opportunities.
- Assisting in a cooperative assessment of damages due to the release of mercury, PCBs, and radionuclides at Oak Ridge Reservation in Tennessee. Constructed a habitat equivalency analysis for aquatic injuries, and assessed the scale of ecological and human use restoration credits provided by a large parcel of forested land at the site. Currently working with the U.S. Department of Energy and the State of Tennessee to resolve claims for groundwater damages as well as damages associated with remaining terrestrial and aquatic injuries.
- Serving as an expert for the U.S. Department of Justice and the Navy on the economic valuation of injuries to the Allen Harbor clam fishery in Rhode Island, as well as damages associated with contamination of groundwater at the site.
- Serving as an expert for the U.S. Department of Justice and the Army on the economic valuation of contamination of groundwater at the Rocky Mountain Arsenal site in Colorado.
- Assessing a proposed set of restoration options offered by Maine Yankee to compensate for injury to groundwater and marine resources at this former nuclear powered generating station.
- Assisting the States of New Jersey, Massachusetts, and Missouri in the development of guidance for natural resource damage assessment associated with injury to groundwater and habitat resources.
- Providing technical support to a cooperative assessment of damages associated with a large-scale bird kill at Lake Apopka, Florida.
- Providing technical support to the National Park Service in the assessment of damages due to an oil spill on the Obed River, Tennessee.

- Directing efforts to assess natural resource damages due to the collapse of a major coal ash storage impoundment on the Tennessee River in Tennessee.
- Conducting and managing various damage assessment activities and developing a formal, publicly released plan for the assessment of damages and the development of restoration options associated with injuries to the Grand Calumet River and Indiana Harbor in northwest Indiana.
- Directing an assessment of economic damages to Fish Creek in Indiana as a result of a fuel oil pipeline break. This assessment focused on potential damages associated with a federally listed endangered species in the creek.
- Assisting New York State in negotiations regarding recreational fishing losses due to the release of mirex to Lake Ontario. Also conducted a source allocation of PCBs, dioxins and mirex in the Niagara River and Lake Ontario, and assessed the likely persistence of these contaminants in Lake Ontario.
- Assessing damages to natural resources resulting from the release of PCBs to the Housatonic River in Massachusetts and Connecticut. Assisting the trustees in settlement negotiations. Assisting in the development of a Restoration Project Selection Criteria document and in a Programmatic Environmental Assessment under NEPA for restoration actions at this site.
- Developing a guidance manual on the use of economics in natural resource damage assessment, and conducting a series of training sessions on this topic for the U.S. Fish and Wildlife Service.
- Providing technical and managerial support in the Federal effort to estimate economic damages resulting from the *Exxon Valdez* oil spill. This included assisting in the preparation and analysis of results from a nationwide contingent valuation survey designed to estimate changes in the passive-use value of Prince William Sound as a result of this oil spill.
- Participating in a cooperative damage assessment at the John C. Heinz National Wildlife Refuge, Philadelphia, Pennsylvania. This effort involves assessment of ecological and human use losses resulting from an oil pipeline spill within the Refuge.
- Providing general case management support to Federal and tribal trustees pursuing a claim for natural resource damages associated with mine tailings-related injuries to the Cheyenne River in South Dakota. This support included development of case strategy, participation in settlement negotiations, and preparation for a focused damage assessment.
- Providing technical and economic support to the Trustees of Lavaca Bay, Texas. Efforts include estimating economic losses suffered by recreational anglers and losses resulting from increased dredging costs associated with mercury contaminated sediments; case management support, including direction of a geostatistical analysis of mercury contamination of bay sediments and direction of a detailed review of historical releases from the site; and developing a draft preassessment screening document.
- Providing case strategy and technical support to the National Park Service in assessment of damages to Grant-Kohrs National Historical Site, Deer Lodge, Montana, resulting from contamination of portions of the Park with mining-related wastes.
- Providing a technical report and affidavit for the U.S. Department of the Interior, National Park Service, regarding economic damages associated with PCB contamination of Valley Creek in Valley Forge National Park.
- Developing a guidance document on damage assessment under Section 19(jj) of the Park Service Protection Act, for the National Park Service's Damage Assessment group.

- Providing support to a hedonic property valuation study designed to assess the impact of PCB contamination on housing values in New Bedford, MA.
- Preparing a formal preassessment screen and damage assessment plan for the PCB-contaminated Hudson River site for Federal and state trustee agencies. Directed the development of a recreational fishing damage model and damage estimates.
- Providing support to the National Oceanic Atmospheric Administration in the development of expedited damage assessment regulations and guidelines under the Oil Pollution Act of 1990.
- Assisting in the analysis of settlement components to support trustee claims arising from the January 2, 1990 Arthur Kill, New York Harbor oil spill.
- Assisting the State of Florida in the development of state guidelines for the conduct of natural resource damage assessments following major oil spills.
- Assisting the State of New York in the development of a natural resource damage assessment plan for the Onondaga Lake System.
- Providing an Expert Witness Narrative for the U.S. Department of Justice and National Oceanic Atmospheric Administration on the application of the habitat equivalency approach to the assessment of natural resource damages resulting from the Blackbird Mine site in Idaho.
- Providing technical and expert witness preparation support to the U.S. Department of the Interior, Fish and Wildlife Service, and the Department of Justice in natural resource damage claims resulting from the release of asbestos and other hazardous substances in the Great Swamp National Wildlife Refuge, New Jersey.
- Providing technical and expert witness preparation support to the Department of Justice and National Oceanic Atmospheric Administration to support claims arising from the grounding of the freighter Elpis in the Key Largo Natural Marine Sanctuary, Florida.
- Providing litigation preparation and expert witness support to National Oceanic Atmospheric Administration and the U.S. Department of Justice to support claims for injury to marine bird populations resulting from the Apex Houston oil spill, California.
- Providing technical support to National Oceanic Atmospheric Administration in the development of a contract management system to facilitate tracking and recovery of costs incurred in the conduct of natural resource damage assessment cases.
- In addition to the above cases, provided damage assessment and case strategy support at over 50 other sites in the U.S. and Caribbean, such as the Bayou Meto ("Vertac") dioxin site in Arkansas; Saginaw Bay in Michigan; Elliott Bay in Seattle; Jamaica Bay, Newtown Creek, Westside site, and Buffalo River, New York; SRS site in Connecticut; White River in Indiana; Union City site in Indiana; Holden Mine and Upper Columbia River sites, Washington; Metal Bank, Pennsylvania; Midnight Mine, Idaho; Sauget site, Illinois; Saltville, South River and Avtex sites in Virginia; Calf Pasture Point, Rhode Island; Acorn Fork in Kentucky; Colrain Acid Spill, Massachusetts; Koch Oil site, Minnesota; Christina River and several other confidential sites in Delaware.
- In addition to the above cases, providing technical support in the development of damage claims for tribal resources, such as Clark Fork River Basin of western Montana for the Confederated Salish and Kootenai Tribes of the Flathead Reservation; along the Cheyenne River in South Dakota for the Cheyenne River Sioux Tribe; in Akwesasne for the St. Regis Mohawk Tribe, Massena, New York; for the Penobscot Nation, Penobscot River, Maine; Spokane Tribe of Indians and the Confederated Tribes of the Colville Reservation for the Midnight Mine site, and the Upper Columbia River site; for the Suquamish Tribe for damages associated with

the Point Wells oil spill and the Duwamish River site; for the Wampanoag on Martha's Vineyard following the *Bouchard* oil spill in Buzzards Bay, Massachusetts; for the Leech Lake Band of Ojibwa at the St. Regis Paper site; and for the Navajo Nation for impacts due to the Gold King Mine release. Mr. Unsworth has also provided technical support to the U.S. Department of Justice (representing the U.S. as defendant) for natural resource damage claims brought by the Quapaw Nation.

Private and State Claims for Damages

Mr. Unsworth provides technical and case strategy support in the context of private claims for damages associated with environmental contamination, oil spills, and forest fires, and other changes in the natural environment and natural resources. Examples of this work include:

- Assessing the economic impacts to Mississippi associated with groundwater withdrawals by the City of Memphis. With Dr. Raymond Kopp, provided expert testimony for the defendant, the City of Memphis and Memphis Light, Gas and Power, on the correct approach to value any economic impacts to Mississippi. Case was ultimately dismissed.
- Assessed the damages to a private landowner in New Jersey resulting from the Warren Grove Gunnery Range wildland fire. Provided expert testimony for the U.S. Air Force and Department of Justice as defendants in this matter on the correct approach to value the plaintiff's losses.
- Serving as an expert in the valuation of losses suffered by lobstermen impacted by the collapse of the western Long Island Sound lobster fishery.
- Serving as an expert in assessing damages to residential property owners associated with air emissions from a meat packing plant.
- Providing technical support, in cooperation with Dr. Raymond Kopp, to an assessment of added costs and property value losses associated with groundwater contamination of a residential neighborhood in suburban Chicago.
- Assessing the impacts on residential property values resulting from a plume of petroleum products under a residential neighborhood in Indiana.
- Estimating the diminution in value of a potential real estate development associated with groundwater contamination at a site in the Caribbean.
- Serving as an expert witness in a private claim for property value diminution resulting from the presence of contaminated groundwater at a site in Lakeland, FL. Mr. Unsworth applied hedonic property value techniques as well as benefits transfer to estimate the magnitude of the loss to homeowners at this site. He also provided support in estimation of the size of the class of plaintiffs who would benefit from the settlement.

Primary Economic Research

Mr. Unsworth has directed a wide-range of primary research efforts in the field of environmental and resource economics. Examples of this work include:

- Directing a random utility analysis of economic losses resulting from contamination of Onondaga Lake, N.Y. This study combines existing data from a 1980s survey of recreational angling behavior with recently collected data to estimate economic welfare losses to the citizens of New York State.

- Directing a multi-year study on the economic value of visits to a range of National Park units. Studies include stated preference surveys at two historic forts in Charleston, S.C.; a random utility model of beach visitation, including temporal substitution, in Texas; and a multi-site, revealed preference study in Southern Utah.
- Directing a series of surveys to gather data to support a claim for damages to the visitor experience at historic El Morro fort in San Juan, Puerto Rico. Damages in this case resulted from the presence of a grounded Russian cement freighter, which was hard-aground off the Fort for nearly five months.
- Managing a series of studies for the Electric Power Research Institute designed to estimate the magnitude of economic damage that could result from long-term climate change. Market sectors analyzed include coastal development, agriculture, recreation, and commercial fishing.
- Managing a series of studies to assess the public's perceptions and attitudes toward the potential ecological effects of climate change. This effort involves a team of academic economists, psychologists, survey researchers and physical and biological scientists, and includes a range of research approaches to address this issue.
- Assessing the regional economic contribution of beach use on the Texas Gulf Coast. This research effort included development and implementation of a telephone survey to determine the number of trips taken to various beaches in Texas, as well as consumer expenditures associated with those trips.

Regulatory Economics

Examples of Mr. Unsworth's work in the area of regulatory economics include:

- For the State of Tennessee, developed a guidance document on the application of economics to decision-making under the Clean Water Act's anti-degradation standards (i.e., justifying whether the economic and social benefits of the project are significant enough to justify the proposed degradation).
- For the California Energy Commission, assessing the state of the science for monetizing the ecological impacts associated with once-through cooling at electricity generating facilities.
- For the Department of the Interior's Office of Surface Mining, developed a regulatory impact analysis and economic and social portions of the environmental impact statement for the revised Stream Protection Rule rulemaking. This effort involved working with a variety of expert subcontractors addressing coal market economics, coal mine engineering, and regional economics.
- Conducting an assessment of potential changes in ecological and human use services within a bay system in California resulting from changes in cooling technology at two large electricity generating facilities.
- Conducting an economic assessment of management alternatives for the Environmental Impact Statement on the incidental take of small numbers of Florida manatees resulting from government programs related to watercraft operation and watercraft access in the State of Florida.
- Participating in developing a programmatic Environmental Impact Statement of Coast Guard actions under the Oil Pollution Act to enhance oil spill response capabilities.
- Directing a series of analyses of the economic efficiency (social welfare) and regional economic effect of critical habitat designation under the Endangered Species Act. Over 50 separate analyses to date, involving habitat throughout the continental U.S and Hawaii. Many of these studies have been conducted under tight court-ordered deadlines.

- Providing guidance to the U.S. Fish and Wildlife Service on the legal requirements for, and appropriate economic approach to, analyses of relicensing proposals for hydropower projects.
- Managing a meta-analysis of 150 contingent valuation and travel cost-based sport fishing valuation studies in order to provide an analytic tool to be used in damage assessment and policy analyses conducted by the U.S. Department of the Interior.
- Supporting the development of an analytical framework for assessing the costs and economic, environmental, and human health benefits associated with regulatory initiatives intended to improve pipeline performance and safety for the Department of Transportation's Office of Pipeline Safety.
- Providing technical and administrative support to the National Oceanic Atmospheric Administration, including support in selecting methods that could be used to estimate economic damages; determining the strengths and weaknesses of each relevant assessment methodology for the determination of damages to a variety of resource categories; and selecting principal investigators to perform these damage assessments.
- Managing efforts to compile review and apply human health and environmental benefit estimates, models, and data sets to support retrospective and prospective benefits assessment under Section 812 of the Clean Air Act.
- Developing and implementing an ecological benefits assessment approach based on probabilistic economic benefit assessment for use in the Environmental Protection Agency's chemical risk management review process.
- Conducting an analysis for the Environmental Protection Agency of the economic benefits that would result from proposed pharmaceutical industry effluent guidelines.
- Estimating the economic benefits associated with environmental quality improvements that could result from reductions in the release of chloroparaffins to three representative aquatic systems.
- Managing a series of case studies for the Environmental Protection Agency to assess the extent to which firms have closed operations as a result of the Clean Air Act, and to identify factors that could be used to predict such closures.
- Managing an economic analysis for the Environmental Protection Agency of the impact on the integrated U.S. steel industry of proposed regulations limiting emissions of hazardous air pollutants.
- Managing an assessment for the Environmental Protection Agency of financial, regulatory, legislative, and market factors facing chlorofluorocarbon producers and users in moving to production and use of non-CFC substitutes.
- Managing the assessment of social costs and economic impacts for the Regulatory Impact Analysis of regulations restricting land disposal of hazardous wastes.
- Assisting in an analysis of the economic impacts of regulations constraining the burning of hazardous waste-as-fuel in industrial boilers and furnaces for the Environmental Protection Agency.
- Providing technical and econometric analysis to support expert testimony for the American Newspaper Publishers Association in hearings before the U.S. Postal Rate Commission.

Public Policy Analysis

Examples of Mr. Unsworth's work in the field of public policy analysis include:

- For the Atlanta Regional Commission, directed the development of a linked hydrological-economic model of the regional and national economic effects of changes in management regime by the Corps of Engineers Buford Dam Project (Lake Lanier).
- For the Kaibab Paiute Tribe, assessing the economic benefits to the State of Utah of a water pipeline right-of-way across the Kaibab Paiute Indian Reservation.
- For the U.S. Department of the Interior, Bureau of Ocean Energy Management, directed substantial updates to the Bureau's Offshore Environmental Cost Model (OECM) and MarketSim models. The OECM allows the Bureau to understand the environmental and social costs and benefits of varying offshore oil and gas development leasing scenarios. The MarketSim model allows for an understanding of the market implications of offshore oil and gas leasing by the U.S. Department of the Interior.
- For the Confederated Tribes of the Umatilla Indian Reservation, estimated the economic benefits associated with enhanced fisheries management and other ecosystem service benefits of the proposed Columbia River Water Exchange Project.
- For the U.S. Department of the Interior, Minerals Management Service, assessed the comparative externalities associated with a range of conventional and offshore renewable energy sources.
- Assisting the Navajo Nation in understanding the level of use payment due to the Hopi Nation under the existing agreement for partition of Navajo and Hopi lands.
- Conducted a study of the economic benefits that have resulted from the successful restoration of the Atlantic coast striped bass fishery.
- Directing an analysis of the regional economic and social impacts of efforts to reintroduce the Mexican wolf to Arizona and New Mexico.
- Conducting an economic analysis of piping plover recovery activities on the Atlantic coast, for the U.S. Department of the Interior, Fish and Wildlife Service. The paper that will result from this research will consider regional economic impacts as well as welfare effects at six case study sites.
- Conducting a study to assess the likely effect of a change in the departure point for Fort Sumter on Park visitation and the local economy. This study involved a series of in-person surveys with Park visitors and tourists in Charleston, S.C.
- Directing a study of the regional welfare economic importance of the horseshoe crab. This study considered the role the crab plays on the pharmaceutical industry, ecotourism, and the commercial fishing industry, and estimated jobs, economic activity, and welfare values associated with each of these uses of the crab.
- Assessing the regional economic impact that would result from the proposed Aldo Leopold National Wildlife Refuge, Wisconsin. Considered the likely baseline use of the area that would be included in the extant boundaries of the Refuge, under several scenarios.
- Assessing the role the Monomoy National Wildlife Refuge plays in the local economy of Chatham, Massachusetts, and in the entire Cape Cod region. Constructed a set of response functions that describe the change in regional economic conditions (i.e., jobs, revenues, etc.) that would result from various changes in allowed uses of the Refuge.
- Assessing the regional economic importance of four National Wildlife Refuges near Bristol Bay, Alaska.
- Estimating the value of recreational fishing improvements associated with proposals to increase water temperatures below a dam on the Guadalupe River in Texas. The analysis used benefits transfer techniques

and studies of fish populations and fishing activity to estimate increased angler days and related welfare benefits.

- Developing estimates of the contribution to the local economy of the Necedah National Wildlife Refuge in central Wisconsin, for the U.S. Fish and Wildlife Service.
- Developing an analysis of flowage (i.e., flood water) easement valuation, including the role of less-than-fee acquisition in non-structural flood control, for the U.S. Department of the Interior, Fish and Wildlife Service.
- Developed a report describing the potential uses of welfare economics in the assessment of hydropower dam projects for the World Commission on Dams, South Africa.
- Reviewing and providing technical comments for the World Bank on the environmental and human health valuation methodologies used in a draft National Environmental Action Plan for Moldova.
- Assessing the potential magnitude of market and non-market economic damages from the loss of forest land in the southeastern United States expected to result from climate change.
- Managing a screening analysis to determine the degree of financial burden imposed on Massachusetts' cities and towns as a result of existing and proposed state and federal environmental requirements.
- Participating in a review of the characteristics and effectiveness of non-regulatory agricultural non-point source reduction programs run by various state authorities.
- Conducting an assessment of historical applications of hazardous substance release events data in environmental policy analysis, as part of an EPA effort to assess the needs for a chemical accident prevention database.
- Managing a data gathering effort to support an assessment of the marginal impact of federally mandated materials separation requirements on proposed municipal solid waste combustion facilities.
- Managing an analysis of consumer purchasing behavior in response to a variety of municipal solid waste management initiatives.
- Managing the development of a computer software package to be used by Local Emergency Planning Committees to set priorities under SARA Title III.
- Developing a chemical and fuel input-output model of the U.S. economy, for use in estimating chemical and fuel expenditures by manufacturing and non-manufacturing facilities.
- Analyzing the structure of the commercial hazardous waste treatment and disposal industry to support an assessment of the impact of federal regulations on this industry.
- Assisting in the preparation of a long-term forecast of capacity for various commercially available hazardous waste treatment technologies, including an assessment of the impact of proposed regulations on capacity.

Publications and Presentations

Mendelsohn, Robert, Daniel Hellerstein, Michael Huguenin, Richard Brazee, and R. Unsworth, 1992, "Measuring Hazardous Waste Damages with Panel Models," *Journal of Environmental Economics and Management* 22:259-271.

Bishop, Richard and Robert Unsworth, 1994, "Assessing Natural Resource Damages Using Environmental Annuities," *Ecological Economics* 11:35-41.

Environmental Performance of Tanker Designs in Collision and Grounding: Method for Comparison.

Committee for Evaluation Double-Hull Tanker Design Alternatives, Marine Board, Transportation Research Board, The National Academies. Washington, DC. 2001.

Issues and Environmental Impacts Associated with Once-Through Cooling at California's Coastal Power Plants, Support Studies and Technical Appendices. Appendix E: Economic Costs of Once-Through Cooling Impacts. California Energy Commission, Staff Report, June 2005. CEC-700-2005-013-AP-A.

Issues and Environmental Impacts Associated with Once-Through Cooling at California's Coastal Power Plants, in support of the *2005 Environmental Performance Report* and *2005 Integrated Energy Policy Report* (Docket 04-Iep-1). California Energy Commission, Staff Report, June 2005. CEC-700-2005-013 Chapter 7.

Economic Valuation of Natural Resource Damages: Groundwater. Presentation to the Law Seminars International, Natural Resource Damages Litigation. Santa Fe, NM, July 9-10, 2009

Equivalency Methods in Natural Resource Damage Assessment. Presentation to the Law Seminars International, Natural Resource Damages. Newark, NJ, November 12-13, 2009

Factors Trustees Consider in Selecting Damage Assessment Approaches. Presentation to the Fourth Annual Advanced Conference on Natural Resource Damages, Law Seminars International. Santa Fe, NM, July 15-16, 2010.

Identifying and Accounting for Cultural Use of Natural Resources in the NRDAR Process, Economic and Other Methodologies. Presentation to the State and Tribal Government Working Group, 2011 Natural Resource Damage Assessment and Restoration Workgroup. Albuquerque, NM, February 15-16, 2011.

Assessment of Lost Cultural Use in the NRDAR Process. Presentation to the DOI Annual NRDA Restoration Workshop, Tribal Session. Phoenix, AZ, March 28, 2011.

An Introduction to Tribal Natural Resource Damage Claims. Prepared (with Dr. Gerald (Taiaiake) Alfred) for the Law Seminars International Conference on Natural Resource Damages. Santa Fe, NM, July 14-15, 2011.

Thoughts on Early Restoration and the Measurement of the Benefits of Enhanced Remediation in the Context of Natural Resource Damage Assessment. Presentation to the Ad-Hoc Industry Natural Resource Damage Group 8th Annual Natural Resource Damage Symposium. Washington, DC, October 25-26, 2011.

Genova, Leslie, Robert E. Unsworth, and David S. Brookshire. 2012 "Impacts of Endangered Species Protection on Water Management, Allocation and Use in New Mexico." In: Water Policy in New Mexico: Addressing the Challenge of an Uncertain Future. Resources for the Future Press, Washington, DC.

Natural Resource Damage Claims Using Habitat and Resource Equivalency: The Case of Wildland Fire. Law Seminars International, Natural Resource Damages: *Evolving strategic, tactical and substantive issues*. Washington, DC, February 14-15, 2013.

Natural Resource Damage Assessment in the Context of Tribal Trusteeship. With Robert Unsworth, Leah Shearer, Leslie Genova, and Nadia Martin, Law Seminars International, Natural Resource Damages: Santa Fe, NM, July 19, 2013.

California Assembly Bill 1492: An Economist's View of Implications for Wildland Fire Damages Claims. Wildland Fire Litigation Conference. Monterey, CA, April 21, 2013.

Trustee Considerations in Applying Non-use Valuation Methods for Purposes of NRDA. Law Seminars International, 8th Annual Advanced Conference on Litigating Natural Resource Damages (NRD), Santa Fe, NM, 24-25 July 2014.

An Introduction to Natural Resource Damage Assessment. Regional Response Team III. Virginia Beach, VA May 20, 2015.

"Experience of remedial measures taken after an armed conflict." Seminar on the Protection of the Environment in relation to Armed Conflict. For: the Permanent Missions to the United Nations of Sweden, Denmark, Finland, Iceland and Norway, Rutgers University, the Environmental Law Institute and the

International Union for Conservation of Nature World Commission on Environmental Law, New York, NY, 29 October 2015.

“The Role of Science and Economics to Advance Tribal Interests in an Uncertain World.” With Jane Israel. 2016 Tribal Lands & Environment Forum: A National Conversation on Tribal land and Water Resources. August 17, 2016.

“Natural Resource Damage Assessment: Groundwater” For: Invited Regulatory Development Session. State of Vermont, Department of Environmental Conservation. 24 August 2016.